CLAIMS

What is claimed is:

1. An apparatus to generate a seek direction detecting signal for an optical pickup, comprising:

a light dividing unit to divide an incident light beam into a main beam and a sub-beam to form a main beam spot and a sub-beam spot having an optical aberration, the main beam and the sub-beam being focused in a track direction of an optical disk, the light dividing unit being disposed so that a direction of the optical aberration is in a radial direction of the optical disk;

an optical detector comprising

a first optical detector having light receiving portions to receive the main beam reflected from the optical disk, and to convert portions of the reflected main beam into independent first electrical signals, and

a second optical detector to receive the sub-beam reflected from the optical disk, and to convert portions of the received sub-beam into independent second electrical signals; and

a signal processing portion comprising

a first signal processing portion to detect a track error signal from the first electrical signals, and

a second signal processing portion to generate the seek direction detecting signal from the second electrical signals and the track error signal.

2. The apparatus as claimed in claim 1, wherein

the second optical detector comprises

an inner pair of first and second inner light receiving portions arranged in a direction corresponding to the radial direction of the optical disk, and

an outer pair of first and second outer light receiving portions disposed at outer sides of the first and second inner light receiving portions, respectively; and

the second signal processing portion generates the seek direction detecting signal from the second electrical signals respectively detected by the outer pair of first and second outer light receiving portions, and the inner pair of first and second inner light receiving portions.

3. The apparatus as claimed in claim 2, wherein widths of the first and second inner light receiving portions are narrower than a radius of a beam spot of the incident light beam focused on said optical detector.

4. The apparatus as claimed in claim 3, wherein a combined width of the first and second inner light receiving portions is 0.2 to 0.8 times a diameter of a beam spot of the incident light beam focused on said optical detector.

5. The apparatus as claimed in claim 2, wherein:

the second signal processing portion includes a differential amplifier that differentiates both the second electrical signal of the outer pair of the first and second outer receiving portions and the second electrical signal of the inner pair of the first and second inner receiving portions, and outputs a track cross signal; and

the second signal processing portion generates the seek direction detecting signal using a phase difference between the track cross signal and the track error signal.

6. The apparatus as claimed in claim 2, wherein,

the second electrical signals output from the outer pair of the first and second outer light receiving portions are S_{P1} and S_{P4}, the second electrical signals output from the inner pair of the first and second inner light receiving portions are S_{P2} and S_{P3},

the second signal processing portion comprises

a first differential amplifier to differentiate the signals S_{P1} and S_{P4} and to output a signal $S_{(P1-P4)}$,

a second differential amplifier to differentiate the signals S_{P2} and S_{P3} and to output a signal $S_{(P3-P2)}$,

a gain adjusting unit to multiply the electrical signal output from the second differential amplifier by a predetermined gain coefficient K, and to output a signal $K \times S_{(P3-P2)}$, and

a summing amplifier to sum the signal $S_{(P1-P4)}$ and the signal $K \times S_{(P3-P2)}$, and to output a track cross signal, and

the second signal processing portion generates the seek direction detecting signal using a phase difference between the track cross signal and the track error signal.

7. An apparatus to generate a seek direction detecting signal for an optical pickup, comprising:

a light dividing unit to divide an incident light beam into a main beam and a sub-beam to form a main beam spot and a sub-beam spot having an optical aberration, the main beam and the sub-beam being focused in a track direction of an optical disk, the light dividing unit being disposed so that a direction of the optical aberration is a radial direction of the optical disk;

an optical detector comprising

a first optical detector having light receiving portions to receive the main beam reflected from the optical disk, and to convert portions of the received main beam into independent first electrical signals, and

a second optical detector having first, second, and third light receiving portions disposed in a direction corresponding to a tangential direction of the optical disk, and fourth, fifth, and sixth light receiving portions disposed adjacent to respective ones of the first, second, and third light receiving portions in a direction corresponding to the radial direction, and disposed in a direction corresponding to the

tangential direction to receive the sub-beam reflected from the optical disk and to convert portions of the received sub-beam into independent second electrical signals; and

a signal processing portion comprising

a first signal processing portion to detect a track error signal from the first electrical signals, and

a second signal processing portion to generate the seek direction detecting signal using the track error signal and by differentiating a sum of electrical signals output from the first, third, and fifth light receiving portions, and a sum of electrical signals output from the second, fourth, and sixth light receiving portions.

8. An apparatus to generate a seek direction detecting signal used to determine a location of a light beam incident on an optical disk, comprising

a light dividing unit to divide a light beam into a main beam and a sub-beam disposed in a line incident on a common track of the optical disk, the sub-beam having an optical aberration that is not disposed in the line to be incident on the common track;

light receiving portions to receive the main beam and sub-beam reflected from the optical disk, and to generate first signals from the reflected main beam and second signals from the reflected sub-beam; and

a signal processing portion to generate the seek direction detecting signal using the first signals and second signals.

9. The apparatus as claimed in claim 8, wherein

said light receiving portions comprise

first light receiving portions to receive the reflected main beam and to generate the first signals, and

second light receiving portions to receive the reflected sub-beam and to generate the second signals, and

said signal processing portion comprises

a first signal processing portion to output a track error signal from the first signals, and

a second signal processing portion to output the seek direction detecting signal from the second signals and the track error signal.

10. The apparatus as claimed in claim 9, wherein the first signal processing portion comprises a push-pull signal unit that generates push-pull signals from the first signals, and the track error signal is based upon the push-pull signals.

11. The apparatus as claimed in claim 10, wherein

the push pull unit comprises summing amplifiers that sum the first signals from the light receiving portions located adjacent to each other in a tangential direction of the optical disk, and

the first signal processing portion further comprising a differential amplifier to differentiate the push-pull signals to output the track error signal.

12. The apparatus as claimed in claim 9, wherein the second signal processing portion comprises a track cross signal generator that generates a track cross signal from the second signals.

13. The apparatus as claimed in claim 12, wherein the second optical light receiving portions comprises inner and outer light receiving portions aligned along a radial direction of the optical disk, and the inner light receiving portions being disposed between the outer light receiving portions.

14. The apparatus as claimed in claim 13, wherein the track cross signal generator comprises a differential amplifier to differentiate a first summed pair of the second signals from a first pair of the inner and outer light receiving portions and a second

summed pair of the second signals from a second pair of the inner and outer light receiving portions.

15. The apparatus as claimed in claim 13, wherein the track cross signal generator comprises

a first differential amplifier to differentiate the second signals from the outer light receiving portions,

a second differential amplifier to differentiate the second signals from the inner light receiving portions,

a gain control unit to gain control the differentiated second signals received from the second differential amplifier, and

a summing amplifier to sum the differentiated second signals from the first differential amplifier with the gain controlled second signals from the gain control unit to generate the track cross signal.

16. The apparatus as claimed in claim 9, wherein the second signal processing portion comprises a track cross signal generator that generates a track cross signal from the second signals without the first signals.

17. The apparatus as claimed in claim 16, wherein the second signal processing portion generates the seek direction detecting signal by comparing a phase difference between the track cross signal and the track error signal.

18. The apparatus as claimed in claim 13, wherein a combined width of the inner light receiving portions is 0.2 to 0.8 times a diameter of a beam spot formed by the reflected sub-beam on the optical disk.

19. An optical pickup apparatus to record/reproduce to/from an optical disk, comprising:

a light source to emit a light beam,

a light dividing unit to divide the light beam into a main beam and a sub-beam disposed in a line to be incident on a common track of the optical disk, the sub-beam having an optical aberration that is not disposed in the line to be incident on the common track;

an objective lens to focus the main beam and sub-beam on the optical disk;

light receiving portions to receive the main beam and sub-beam reflected from the optical disk, and to generate first signals from the reflected main beam and second signals from the reflected sub-beam; and

a signal processing portion to generate the seek direction detecting signal using the first signals and the second signals.

20. The optical pickup apparatus as claimed in claim 19, wherein

said light receiving portions comprise

first light receiving portions to receive the reflected main beam and to generate the first signals, and

second light receiving portions to receive the reflected sub-beam and to generate the second signals, and

said signal processing portion comprises

a first signal processing portion to output a track error signal from the first signals, and

a second signal processing portion to output a seek direction detecting signal from the second signals and the track error signal.

21. The optical pickup apparatus as claimed in claim 20, wherein the first signal processing portion comprises a push-pull signal unit that generates push-pull signals from the first signals, where the track error signal is based upon the push-pull signals.

22. The optical pickup apparatus as claimed in claim 21, wherein

the push pull unit comprises summing amplifiers that sum the first signals from light receiving portions located adjacent to each other in a tangential direction of the optical disk, and

the first signal processing portion further comprising a differential amplifier to differentiate the push-pull signals to output the track error signal.

23. The optical pickup apparatus as claimed in claim 20, wherein said second signal processing portion comprises a track cross signal generator that generates a track cross signal from the second signals.

24. The optical pickup apparatus as claimed in claim 23, wherein the second light receiving portions comprises inner and outer light receiving portions aligned along a radial direction of the optical disk, and the inner light receiving portions being disposed between the outer light receiving portions.

25. The optical pickup apparatus as claimed in claim 24, wherein the track cross signal generator comprises a differential amplifier to differentiate a first summed pair of the second signals from a first pair of the inner and outer light receiving portions and a second summed pair of the second signals from a second pair of the inner and outer light receiving portions.

26. The optical pickup apparatus as claimed in claim 24, wherein the track cross signal generator comprises

a first differential amplifier to differentiate the second signals from the outer light receiving portions,

a second differential amplifier to differentiate the second signals from the inner light receiving portions,

a gain control unit to gain control the differentiated second signals received from the second differential amplifier, and

a summing amplifier to sum the differentiated second signals from the first differential amplifier with the gain controlled second signals from the gain control unit to generate the track cross signal.

27. The optical pickup apparatus as claimed in claim 23, wherein

the second light receiving portions comprise

first, second, and third light receiving portions disposed in a tangential direction of the optical disk, and

fourth, fifth, and sixth light receiving portions disposed adjacent to respective ones of the first, second, and third light receiving portions in a radial direction of the optical disk, and

the second signal processing portion generates a track cross signal by differentiating a first sum of the second signals output from the first, third, and fifth light receiving portions and a second sum of the second signals output from the second, fourth, and sixth light receiving portions.

28. The optical pickup apparatus as claimed in claim 20, wherein the second signal processing portion comprises a track cross signal generator that generates a track cross signal from the second signals without the first signals.

29. The optical pickup apparatus as claimed in claim 27, wherein the second signal processing portion generates the seek direction detecting signal by comparing a phase difference between the track cross signal and the track error signal.

30. The apparatus as claimed in claim 24, wherein a combined width of the inner light receiving portions is 0.2 to 0.8 times a diameter of a beam spot formed by the reflected sub-beam on the optical disk.

31. The optical pickup apparatus as claimed in claim 23, wherein the sub-beam follows the main beam along the common track.

32. The optical pickup apparatus as claimed in claim 23, wherein the main beam follows the sub-beam along the common track.

33. The optical pickup apparatus as claimed in claim 23, wherein

said light dividing unit further divides the light beam into an additional sub-beam disposed in the line to be incident on the common track, the additional sub-beam having an optical aberration that is not disposed in the line to be incident on the common track, and

the main beam is incident between the sub-beam and sub-beam along the common track.

34. The optical pickup apparatus as claimed in claim 29, wherein the sub-beam follows the main beam along the common track.

35. The optical pickup apparatus as claimed in claim 29, wherein the main beam follows the sub-beam along the common track.

36. The optical pickup apparatus as claimed in claim 29, wherein

said light dividing unit further divides the light beam into an additional sub-beam disposed in the line to be incident on the common track, the additional sub-beam having an optical aberration that is not disposed in the line to be incident on the common track, and

the main beam is incident between the sub-beam and sub-beam along the common track.

37. A method of generating a seek direction detecting signal, comprising:

splitting a light beam into a main beam and a sub-beam disposed in a line incident on a common track of an optical disk, where the sub-beam further comprises an optical aberration not disposed in the line and incident off of the common track;

reflecting the main beam and sub-beam off the optical disk; and

generating the seek direction detecting signal based upon the reflected main beam and sub-beam.

38. The method as claimed in claim 37, wherein said generating the seek direction detecting signal comprises:

generating a track cross signal based upon the reflected sub-beam;

generating a track error signal based upon the reflected main beam; and

generating the seek direction detecting signal based upon the track cross signal and the track error signal.

39. The method as claimed in claim 37, wherein the track cross signal is generated without the reflected main beam.